

Preliminary Findings on the Distribution of Polycyclic Aromatic Hydrocarbons in the Bottom Sediments of the Alafia River-Kitchen Bay, Feather Sound, Pinellas Point, and Terra Ceia Areas in Tampa Bay, Florida June 2002

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INTRODUCTION

The U.S. Geological Survey conducted a study in June, 2002, to examine select chemicals, polycyclic aromatic hydrocarbons and total organic carbon (PAHs and TOC) in bottom sediments at four study areas within Tampa Bay, Florida. Thirty sampling sites at each of the four study areas (Alafia River-Kitchen Bay, Feather Sound, Pinellas Point, and Terra Ceia) were selected using a random-stratified sampling method. Fifteen samples with the highest TOC concentrations from each of the four study areas were selected for PAH immunoassay analysis. Maps showing the sampling locations, and tables and charts summarizing the findings are presented in insets A through D. The sampled sites that were analyzed for PAHs and TOC are presented in the maps in shades of red; those sites only analyzed for TOC are presented in white.

METHODS

For the selection of sampling sites, hexagonal grids were superimposed over the four study sites and 30 sampling points were chosen by random selection. This method was used so that the data could be integrated with the Hillsborough County Environmental Protection Commission's (HCEPC) stratified, random, probability-based sampling protocol. The HCEPC has been sampling the bottom of the estuary since 1992. A line 50 m from shore differentiates "inshore" from "offshore" sampling sites.

One hundred and twenty grab samples, about 2 cm into the bottom sediments, were collected and analyzed for TOC, which ranged from 0.00 - 3.61 percent. TOC

concentrations were used to characterize the sediments and to normalize targeted PAH concentrations. Concentrations and toxicity of organic contaminants correlate well with the organic carbon content of sediments (DiToro and others, 1991). Organic contaminants are primarily associated with the organic matter fraction of sediments. Contaminants can migrate through sediment resuspension and deposition, and gradients in contaminant concentrations associated with a source or sources can be observed (Michelsen and Bragdon-Cook, 1993).

PAH was determined by enzyme linked immunosorbent assay (ELISA). An ELISA kit (Rapid Assay Carcinogenic PAH Test Kit [CaPAH]; Strategic Diagnostics Incorporated, 1998) was used that quantitatively identifies 16 carcinogenic PAH compounds. ELISA analysis technology utilizes biologically generated immunoglobulin proteins (antibodies) bound to paramagnetic particles that react with specific target antigens. The calibrating standard used for the test was benzo(a)pyrene. The compounds and their respective limit of quantitation (LOQ) are presented in Table 1. The compounds listed in Table 1 represent the 16 most common high and low molecular weight carcinogenic PAHs that originate from combustion of fossil fuels and urban runoff.

As with all ELISA tests, cross-reactivity must to be considered when interpreting the data. Because more than one compound will react with the ELISA test, a positive result only indicates the presence of one or more compounds that are listed with the PAH kit. For example, since the test does not differentiate among the various PAHs listed in Table 1, a result of 100 µg/kg indicates the presence of one or more of the compounds listed whose LOQ is 100 micrograms per kilograms (µg/kg) or less. The

LOQ is the lowest concentration of the compound in soil that can be quantified. The ELISA screening results presented here will be compared to results obtained using gas chromatography/mass spectroscopy.

RESULTS AND DISCUSSION

Results are presented in insets A-D. Sediment PAH concentrations ranged from 10 to 876 µg/kg. All concentrations were below the Florida Department of Environmental Protection (FDEP, 1994) effects-based Quality Assessment Guideline's, Threshold Effects Level (TEL) of 1,684 µg/kg. The TEL represents the sum of 6 and 7 heavy and light molecular weight PAHs, respectively (FDEP, 1994, p. 53-54). The TEL is defined as representing the upper limit of the range of contaminated sediment concentrations dominated by no adverse biological effects. The ELISA test includes 12 of the 13 PAHs listed by FDEP (1994).

TOC-normalized PAH concentrations for all sites ranged from 2.4 (Feather Sound) to 162.2 µgPAH/gTOC (Pinellas Point) with a mean of 23.2 µgPAH/gTOC for the four study areas. The normalized PAH data can be used to compare the sampling sites (insets A, B, C, and D) in terms of the relative potential impact of PAHs on benthic organisms (FDEP, 1994). Data for the individual inshore and offshore sampling points at the four study areas are presented by bar graphs. The means for the inshore and offshore data ranged from 11.0 to 35.0 µgPAH/gTOC and 18.2 to 33.6 µgPAH/gTOC, respectively.

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DISCLAIMER

This report (map) is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards. Any use of trade, product or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

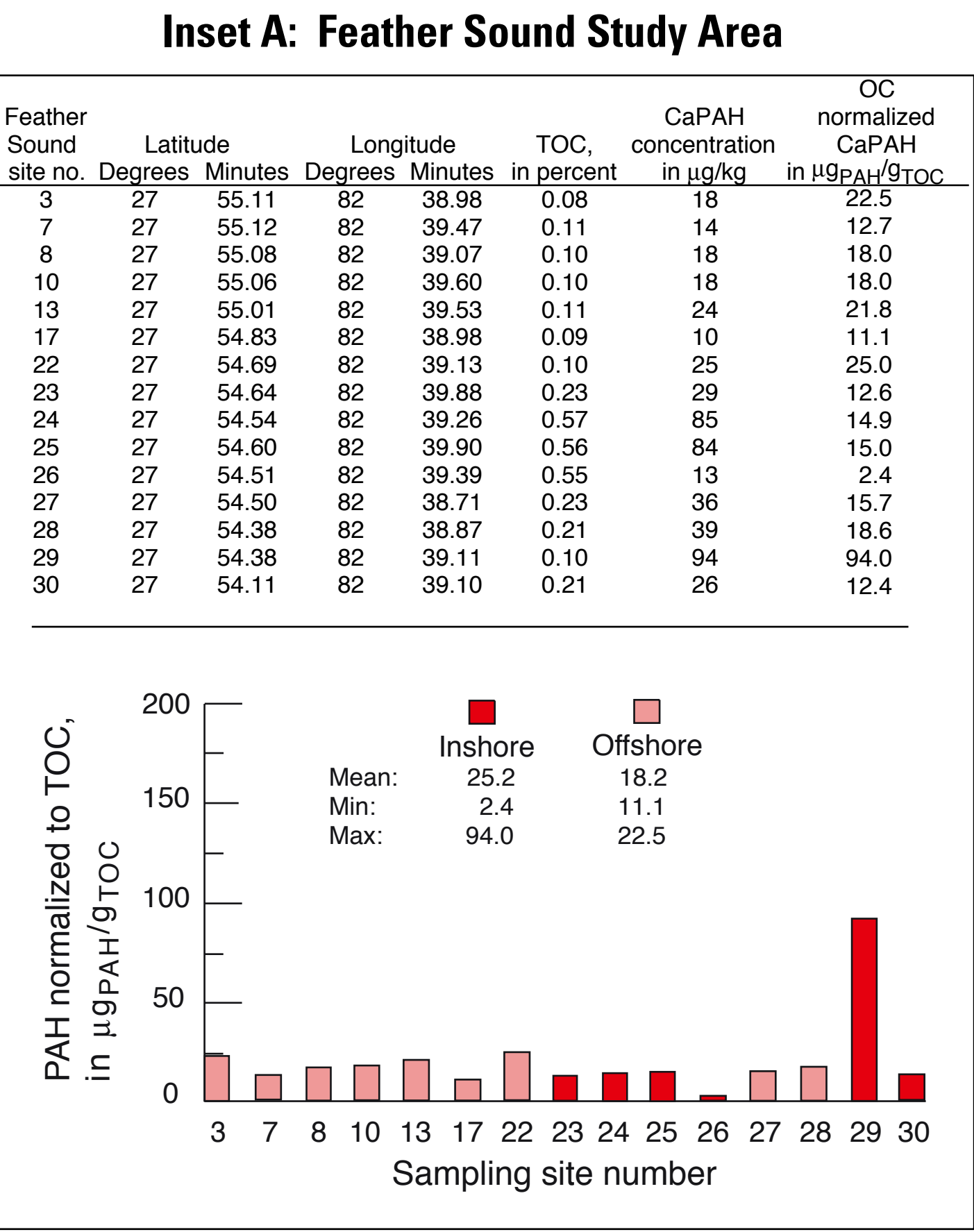


Table 1. ELISA limit of quantitation of selected polycyclic aromatic hydrocarbons in bottom sediments at four study areas in Tampa Bay, Florida, June, 2002.

[LOQ, limit of quantitation in micrograms per kilogram; >, greater than; <, less than]

benzo[a]anthracene	6.0	benzo[a]pyrene	LOQ <100	20.0	dibenzo[a,h]anthracene	30.0
benzo[k]fluoranthene	8.0	chrysene		8.0	indeno[1,2,3-c,d]pyrene	24.6
benzo[b]fluoranthene	16.0					
		fluoranthene	LOQ <1000	856	phenanthrene	840
anthracene	256					
		fluorene	LOQ <10,000	4,280	pyrene	2,920
benzo[g,h,i]perylene	>1,250					
		acenaphthylene	LOQ >10,000	72,200	naphthalene	61,500
acenaphthalene	>125,000					

